

N,N-Bis(trimethylsilyl)methoxymethylamine as a Convenient Synthetic Equivalent for $+CH_2NH_2$: *N,N*-Bis(trimethylsilyl)aminomethylation of Silyl Sulphides and Phosphites

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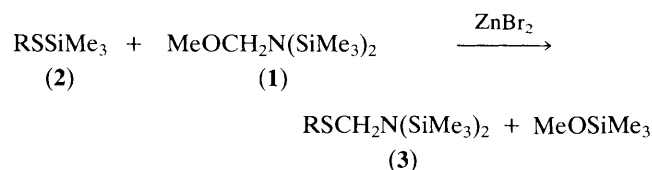
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N-Silyl-protected primary aminomethyl sulphides and aminomethylphosphonates can be synthesised by the Lewis acid-catalysed reactions of silyl sulphides and silyl phosphites with *N,N*-bis(trimethylsilyl)methoxymethylamine.

Earlier papers^{1,2} have reported the use of *N,N*-bis(trimethylsilyl)methoxymethylamine (**1**) as an efficient aminomethylating agent which permits the introduction of the primary aminomethyl unit not only at carbon atoms of organometallic compounds but also at the α -position of carboxylic esters in a few steps. This method is of interest since the Mannich reaction is not applicable to primary aminomethylation.³

We were interested in developing a general synthesis of *N*-silyl-protected primary aminomethyl sulphur and phosphorus compounds by use of (**1**), since they should be useful synthetic intermediates. Secondary or primary amines are known to condense with formaldehyde and thiols or phosphites to afford *N*-mono- or *N,N*-bis-(sulphur or phosphorus substituted methyl)-substituted amines.⁴ However, it is difficult to obtain *N*-mono-substituted amines as major products by a similar condensation using ammonia because of the formation of tertiary amines or other side products.⁵

The reaction of phenylthiotrimethylsilane (**2a**) with (**1**) was found to proceed in the presence of a zinc salt to yield *N,N*-bis(trimethylsilyl)phenylthiomethylamine (**3a**). The relative efficiency of the zinc salts was in the order $ZnBr_2 > ZnCl_2 > (Et_2NCS_2)_2Zn > ZnS$.



In a typical experiment, a mixture of phenylthiotrimethylsilane (**2a**) (10 mmol), the reagent (**1**) (12 mmol), and

anhydrous zinc bromide (0.5 mmol) was stirred and heated at 60 °C for 3 h under nitrogen. The usual work-up and distillation gave the pure thiomethylamino compound (**3a**).

Table 1 shows results for the *N,N*-bis(trimethylsilyl)-aminomethylation of the alkylthiotrimethylsilanes (**2a—d**). The trimethylsilyl dithiocarbamates (**2e,f**) also reacted with (**1**) under the same conditions giving the *N,N*-bis(trimethylsilyl)aminomethylated products (**3e,f**) in high yields.

The *N,N*-bis(trimethylsilyl)aminomethylphosphonates (**5**) were obtained by the reaction of the trimethylsilyl phosphites (**4**) with the reagent (**1**) in the presence of tin(II) chloride; the following procedure is typical. A mixture of the phosphite (**4b**)

Table 1. Reactions^a of alkylthiotrimethylsilanes (**2a—d**) and trimethylsilyl dithiocarbamates (**2e,f**) with (**1**) in the presence of $ZnBr_2$.

Starting material	R	Time/h	Product ^b	% Yield ^c	B.p./°C (p/mmHg)
(2a)	Ph	3	(3a)	98	96 (0.1)
(2b)	PhCH ₂	6	(3b)	87	120 (3)
(2c)	Me[CH ₂] ₅	35	(3c)	73	110 (6)
(2d)	EtOCOCH ₂	0.5	(3d)	82	111 (38)
(2e)	Et ₂ NC(S)	1	(3e)	90	— ^d
(2f)	[CH ₂] ₅ NC(S)	1	(3f)	94	— ^d

^a Molar ratio (**2**):(**1**): $ZnBr_2$, 1:1.2:0.05; temp. 60 °C. ^b All new compounds gave satisfactory microanalytical [except (**3e,f**)] and n.m.r. data. ^c Yield of pure, isolated product [in the case of (**3e,f**) spectroscopically pure]. ^d The products (**3e,f**) were only slightly impure without distillation, which caused their thermal decomposition.

